Wind scanners: New wind and turbulence measurement facilities for wind energy

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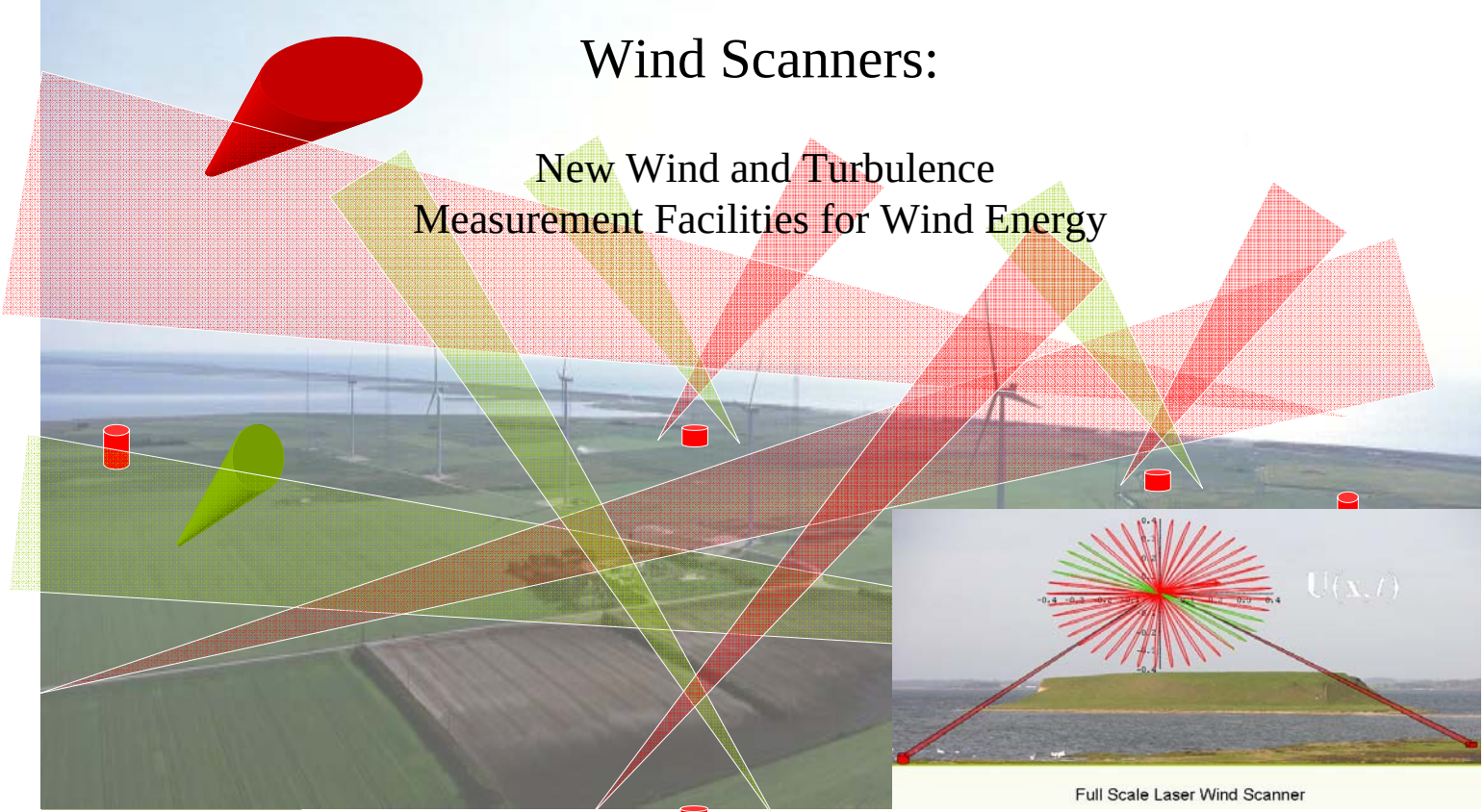
New Wind and Turbulence Measurement Facilities for Wind Energy



Full Scale Laser Wind Scanner

Secure Wind Turbine siting is a major issue for wind resources and structural load assessment on and offshore.

The Wind energy industry has needs for more detailed wind and turbulence information for wind turbines operating at complex sites and at huge heights 100-150 meters above ground. At Risø DTU, Denmark, we are developing a new entirely Remote-Sensing lidar-based wind-scanning facility for full-scale 3-dimensional wind field measurements. Designed to measure 3D wind vectors at several hundred points every second, the Windscanners are designed to map the detailed wind and turbulence fields in front of, during passage, and in the wakes of today and tomorrows huge rotor planes.

A first 3-D prototype wind scanner is build from modified continuous-wave ZephIR wind lidar's operated in concert with individual steerable and focus-controlled beams and a WindCube pulsed lidar for vertical profiling. Equipped with beam-steerable scan heads modified Wind lidar's developed for ground-based remote wind energy assessment enables us to measure the radial wind speed from each lidar at several hundred points every second.

At **Risø DTU** in Denmark, in combination with newly designed fast scanning heads and adjustable focus control, three wind lidar's has now 2009 been combined to form a first 3-D remote sensing based Windscanner.

Our **aim** is to enable new 3-D wind and turbulence field measurements: 1) in front of, 2) during the passage of, and 3) in the wakes of the huge turbines.

The windscanners are envisioned to serve researchers and the wind energy industry with detailed measurements for:

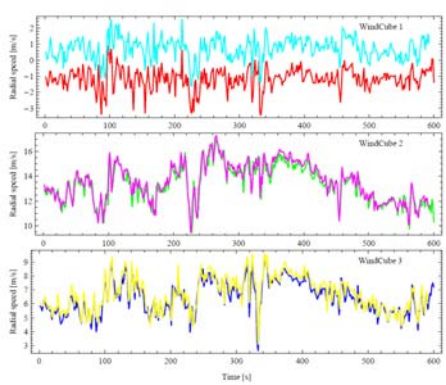
- Optimal siting in complex terrain based on in-situ measurements of wind and turbulence.
- Optimal spacing within arrays by measuring the effects of wakes.
- Spinner-based upwind measurements for active controlling power production and mitigating extreme loads, for improved power performance, and longevity.

At our **web site** Windscanner.dk the windscanners functionality (scan and and data-acquisition rates, and spatial-temporal resolutions) is presented along with our results from the first full-scale testing's (the Musketeer Experiments 2008 and 2009).

Technical details of our new Windscanner research infrastructures can be found in the publications linked to at (Windscanner.dk). We also welcome collaboration and scientific exchange opportunities with other US-based colaboratories.

MusketeerEx 2008:
Høvsøre 2. Windscanner lidar test
Windscanner "Stretch Pod" (left) vs. Windscanner Unit 120 (right)

First 3-D WIND SCANNER Results:
Wind components at 78 m height: Sonic vs. Lidar
MusketeerEx 2007, Høvsøre, Denmark



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